Appendix C

AIRPORT DESIGN STANDARDS & DEVELOPMENT REVIEW

This appendix summarizes the FAA airport design standards and runway considerations for Ellington Airport and introduces potential development scenarios that are intended to satisfy existing deficiencies and future facility demands. Figures depicting the development scenarios are provided at the end of this appendix.

This information is provided in the following sections:

- Airport Design Standards
- Runway Considerations
- Airport Development Review

C.1 Airport Design Standards

Airport design standards are determined by the size of the most demanding aircraft anticipated to use an airport on a regular basis (i.e., at least 500 annual itinerant operations). The FAA defines this as the "Design Aircraft." The selection of a Design Aircraft allows for the identification of an Airport Reference Code (ARC). The ARC has two components. The first component, depicted by a letter, is the Aircraft Approach Category (an operational characteristic), and refers to the aircraft approach speed during landing. The second component, depicted by a Roman numeral, is the Airplane Design Group, and refers to the aircraft wingspan (a physical characteristic). The ARC components are detailed in Table C-1.

TABLE C-1 – AIRPORT REFERENCE CODE

Aircraft Approach Category		Airplane Design Group	
Category	**Dimension**	**Group**	**Dimension**
A	Speed of less than 91 knots	I	Up to but not including 49'
B	91 knots up to but <121 knots	II	49' up to but not including 79'
C	121 knots up to but <141 knots	III	79' up to but not including 118'
D	141 knots up to but <166 knots	IV	118' up to but not including 171'
E	166 knots or more	V	171' up to but not including 214'
-	-	VI	214' up to but not including 262'

Source: FAA Advisory Circular 150/5300-13.

The majority of operations at Ellington Airport are conducted by small piston-powered aircraft; the largest aircraft expected to operate at the Airport include the Piper Saratoga (single-engine) or Beechcraft Baron (twin-engine). Based upon the criteria in Table C-1, these aircraft are classified as ARC B-I small.[1]

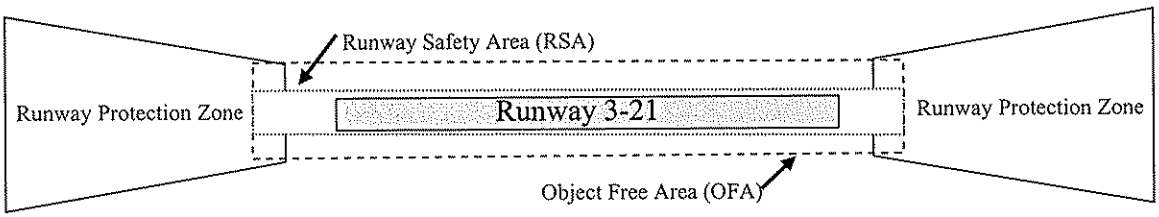
The key design criteria for Ellington Airport are defined and illustrated below.

- Runway Safety Area (RSA) – A defined surface surrounding a runway prepared for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. This area must also support snow removal, aircraft rescue, and fire fighting equipment. The RSA should be free of objects, except for objects that must be located in the area because of their function.

- Runway Object Free Area (ROFA) – A ground area surrounding runways that should be clear of objects (e.g., roads & buildings), except for objects that need to be within the area due to their function.

- Runway-Taxiway Offset – The separation between the runway centerline and parallel taxiway centerline.

- Runway Protection Zone (RPZ) – Areas off the runway ends used to enhance the protection of people and property on the ground. The RPZ is ideally achieved through airport owner control, and the clearing of objects and undesired activities.



[1] ARC B-I small aircraft all have maximum takeoff weights of 12,500 pounds or less.

Table C-2 compares the existing conditions at Ellington Airport against the design standard requirements for ARC B-I facilities. Design standard deficiencies are highlighted in the table.

TABLE C-2 – FAA Design Standards

Design Standard	Existing Condition	Design Standard B-I Small
Runway width	50'	60'
Runway Safety Area (RSA) width	120'	120'
RSA length beyond runway end	63'	240'
Runway Object Free Area (ROFA) width	250'	250'
ROFA length beyond runway end	63'	240'
Runway centerline (CL) to parallel taxiway CL separation	100'	150'
Runway Protection Zone (RPZ) length	325'	1,000'
RPZ inner width	250'	250'
RPZ outer width	450'	450'
Aircraft parking offset from Runway CL	130'	200'
Taxiway width	20'	25'
Aircraft parking offset from Taxiway CL	25'	45'

As indicated in Table C-2, several existing features of the Airport do not satisfy FAA design standards for ARC B-I facilities, including the RSA and RPZ lengths beyond the runway ends, the runway width, the runway-taxiway offset, and the aircraft parking setbacks. These are noteworthy design standard deficiency, and are a high FAA priority. If FAA funding is pursued for improvements to the airport, the deficiencies will need to be addressed.

C.2 Runway Considerations

Runway 1-19 at Ellington Airport is currently 1,800 feet long and 50 feet wide. This section includes an evaluation of the following runway requirements:

- Runway Conditions
- Runway Length
- Runway Orientation

C.2.1 Runway Conditions

The last runway reconstruction project was conducted in the early 1990's and the pavement is currently in fair to poor condition. Pavement rehabilitation is typically conducted every 10 to 20 years, with crack sealing and other minor repairs conducted in the interim years as necessary. A visual inspection of the runway pavement identified traverse, longitudinal, and alligator cracking along the entire length of the runway and areas of settlement. As such, crack repair and a seal coat is recommended in the short term, with full-depth reconstruction completed when funding is available.

C.2.2 Runway Length

Runway length requirements depend on the most demanding aircraft group anticipated to use an airport on a regular basis. The FAA groups general aviation aircraft by maximum takeoff weight (e.g., small, large, or heavy) and number of passenger seats. The aircraft group for Ellington Airport includes small aircraft (i.e., 12,500 pounds or less) with less than 10 passenger seats. Runway length requirements also depend on a number of specific physical and meteorological factors, as listed below:

- Airport Elevation: 253 feet
- Mean Maximum Temperature: 81°F (hottest month – July)
- Wind: Calm (worst case)
- Runway Gradient: Less than one percent

FAA Advisory Circular (AC) 150/5325-4B, *Runway Length Requirements for Airport Design*, describes the procedure for determining recommended runway lengths. The AC provides "Runway Length Curves" that use specific airport characteristics to determine recommended runway lengths for the following general aviation categories:

- ***Category 1 – To accommodate 75% of the small aircraft fleet*** – This category applies to airports that are primarily intended to serve small size population communities with a diversity of usage and a greater potential for increased aviation activities.

- ***Category 2 – To accommodate 95% of the small aircraft fleet*** – This category applies to airports that are primarily intended to serve medium size population communities with a diversity of usage and a greater potential for increased aviation activities.

- ***Category 3 – To accommodate 100% of the small aircraft fleet*** – This type of airport is primarily intended to serve communities located on the fringe of a metropolitan area or a relatively large population remote from a metropolitan area.

Applying the "Runway Length Curves" by using the FAA Airport Design software[2] to the specific physical and meteorological factors of Ellington Airport, the following runway lengths were determined:

- ***Category 1*** – 2,490 feet
- ***Category 2*** – 3,040 feet
- ***Category 3*** – 3,610 feet

Based on the information in the AC, Ellington appears to fit best in Category 1, as it serves a small population community with a diversity of users. Thus, a minimum runway length of 2,500

[2] The data from the FAA Airport Design software is presented in Appendix D.

feet (2,490 rounded) (i.e., a 700-foot extension) is suggested to accommodate 75 percent of the small aircraft fleet. This is a conservative recommendation and considers the proximity to Bradley International and Hartford-Brainard Airports, environmental impacts, and funding availability. Bradley International is currently operating under capacity and has three runways, the longest being 9,510 feet in length.

C.2.3 Runway Orientation

The ideal orientation of a runway is a function of wind speed and direction, and the ability of aircraft to operate under crosswind conditions. As a general rule, runways should be oriented as closely as practical in the direction of the prevailing winds. This enables aircraft to takeoff and land in the direction of the wind, which improves the safety and efficiency of operations. The most ideal runway alignment provides the highest wind coverage percentage. The desired wind coverage for Runway 1-19 has been set by the FAA at 95 percent. This assumes that small aircraft can handle crosswinds of no greater than 10.5 knots (12 mph), and is referred to as the crosswind component.

To determine the existing wind coverage at Ellington Airport, wind data was collected from an Airport Surface Observation System (ASOS) installed at Bradley Airport (BDL), located approximately 10 miles to the east. Based on this data, it is estimated that the 10.5-knot wind coverage at Ellington Airport ranges from 93 to 94 percent. Although it is likely that wind coverage is slightly below the desired level, a second runway is not typically justified for a small general aviation facility, due to modest activity levels and substantial development and maintenance costs.

Based on the wind data from BDL, it is estimated that a runway alignment of approximately a 165 degrees true heading (a magnetic heading of 18-36) would provide the best wind coverage at Ellington Airport at 94%. The runway is currently oriented on a 176-356 degrees true heading, which is very close to the ideal orientation. However, the wind data from BDL may not reflect the localized conditions created by the topography surrounding Ellington Airport. Thus, the ideal alignment can only be estimated with on-site wind data. Local operators at Ellington Airport report that the existing runway alignment provides sufficient wind coverage the majority of the time. It is recommended that the runway alignment generally stay as it is presently in its present north-south orientation.

To determine a more accurate representation of wind coverage, an Airport Weather Observation System (AWOS) would need to be installed at Ellington Airport. If an AWOS is installed in the future, the AWOS-recorded wind data should be collected and reviewed to better understand the localized conditions surrounding the Airport. Note that at least three years of wind data is typically needed to draw useful conclusions about localized wind conditions.

C.3 Airport Development Review

For Ellington Airport, there are several key considerations inherent to the preparation of a generalized long-term development plan, including:

- ***FAA Design Standards*** – There are currently several non-standard airfield design features at Ellington Airport, including the runway width, Runway Safety Area (RSA), Runway Object Free Area (OFA), and runway-taxiway offset. There is also a multi-family dwelling within the RPZ. If the Airport is acquired using federal funds, non-standard features would have to be addressed and corrected to the extent feasible.
- ***Runway Length*** – The runway length is currently 1,800 feet. The recommended length to accommodate 75% of small aircraft is 2,500 feet.
- ***Noise*** – The noise impact on the local community associated with any development should be reviewed to determine compatibility. (See Appendix I for detailed information on the noise impacts of each alternative.)
- ***Other Impacts*** – Costs, environmental impacts, and other concerns associated with the factors above must be carefully evaluated.

These factors are considered in the airfield and landside development options for Ellington Airport. A generalized long-term development plan was prepared following review and comment by the Town of Ellington, State, FAA, and airport users and businesses.

C.3.1 Airfield Options

The long-term development plan must address the FAA B-I design standards associated with the Ellington Airport. As discussed above, the Airport currently does not satisfy many ARC B-I standards. The airfield options below address the current and potential non-standard issues at Ellington Airport.

- **Airfield Alternative 1 – No Build (Figure 1-1)**
  This option would maintain the airfield in its current configuration throughout the foreseeable future. The Airport would continue to provide a runway length of 1,800 feet, with non-standard conditions such as runway width, runway and parallel taxiway offset, and RSA length. However, if the Airport was acquired with federal funds, the FAA would require addressing these non-standard features in order to improve operational safety. The pavement is also at a state where repairs or reconstruction is necessary; if the pavement is not maintained it will become unusable. There are no incompatible land uses based on noise with this alternative.

- **Airfield Alternative 2 – Status Quo (Figure C-1)**
  This alternative would maintain the airfield in its current configuration throughout the foreseeable future with a few minor changes. The Airport would continue to provide a runway length of 1,800 feet, but the pavement would be reconstructed. The alternative would also install a culvert for the stream to the south of the runway to provide a standard RSA, and conduct some limited tree removal. This alternative would not address the residences within the RPZ or the runway-taxiway offset. If the Airport was acquired with federal funds, the FAA may require these non-standard features be addressed in order to

improve operational safety. There are no incompatible land uses based on noise with this alternative.

- **Airfield Alternative 3 – 2,000' Runway (Figure C-2)**
  This alternative includes shifting the runway approximately 250 feet north and 50 feet west. This shift would allow for a standard RSA and runway-taxiway offset. The runway would be widened to 60 feet and extended to 2,000 feet (a 200-foot extension). This extension to 2,000 feet would reduce the insurance premiums for the aircraft owners as they are currently penalized for having their aircraft based at an airport with a runway length under 2,000 feet. The shift north also removes two buildings from within the RPZ, but a small portion of one residential building would still fall within the RPZ. The runway would fall 500 feet short of the recommended length to accommodate 75% of small aircraft.

  The runway extension would require alternative access to the private shortage buildings west of the runway and the jump zone. Access to the private shortage could be provided by the construction of a driveway from the cul-de-sac of Bridge Street. Access to the jump zone could be provided by an improvement to the existing driveway that enters the property from Meadow Brook Road. The location of the driveway and auto parking area would need to be discussed with the CT Parachuters, Inc. to determine their specific use of the jump zone.

  A full length parallel taxiway would be provided for safety and convenience for pilots. In order to control the land within the RPZs, easements would need to be purchased for approximately 5.2 acres. There are no incompatible land uses based on noise with this alternative.

  Minimal tree clearing of approximately 5.4 acres would take place within both RPZ's and along the west of the runway for safety purposes as the trees are airspace obstructions. The clearing would include the removal of all trees over 10 feet tall to create an area of bushy vegetation. There would be little to no environmental impact from this alternative.

- **Airfield Alternative 4 – 2,500' Runway (Figure C-3)**
  This alternative includes improving the runway to 2,500 feet to the north (a 700-foot extension), which is the recommended length to accommodate 75% of small aircraft. The runway would be widened to 60 feet and shifted west 50 feet in order to meet design standards. The stream to the south would be culverted to provide for a standard RSA. Four buildings would remain within the RPZ for this alternative.

  Note: A runway of 2,500 feet does not imply that larger aircraft, such as commercial jets, will be operating at Ellington Airport. The category of aircraft is not anticipated to change over the planning period.

The runway improvement would require alternative access to the private shortage buildings west of the runway and the jump zone. Access to the private shortage could be provided by the construction of a driveway from the cul-de-sac of Bridge Street. Access to the jump zone could be provided by an improvement to the existing driveway that enters the property from the south. The location of the driveway and auto parking area would need to be discussed with the CT Parachuters, Inc. to determine their specific use of the jump zone.

A full length parallel taxiway would be provided for safety and convenience for pilots. In order to control the land within the RPZs, easements would need to be purchased for approximately 7.0 acres. Minimal tree clearing of approximately 8.4 acres would take place within both RPZ's and along the west of the runway for safety purposes as they are considered obstructions. Tree removal would include the removal of all trees over 10 feet tall to create an area of bushy vegetation. In wetland areas, the tree removal would be a moderate environmental impact, but the impact would be minimized by removing the trees when the ground is frozen and leaving the roots intact. There are no incompatible land uses based on noise with this alternative.

TABLE C-3 – SUMMARY OF AIRFIELD ALTERNATIVES

Airfield Alternative (Figure)	Description	Meets Design Standards	Runway Length	Environmental Impacts	Incompatible Land Use (Noise)
Alternative 1 (Figure 1-1)	No Build (Maintain Non-Standard RSA)	No	1,800'	Minimal	None
Alternative 2 (Figure C-1)	Status Quo	Some	1,800'	Minimal	None
Alternative 3 (Figure C-2)	2,000' Runway Length	Yes	2,000'	Minimal	None
Alternative 4 (Figure C-3)	2,500' Runway Length	Yes	2,500'	Moderate	None

Although there are many permutations of the above alternatives and additional options that may be considered, some options were dismissed at the onset of the study. Although, a runway beyond 2,500 feet was not discussed in detail due to the difficulty of justification and potential environmental impacts, it may be a long-term goal of the airport. A 3,200 foot runway would require over seven acres of tree removal within wetlands which would be subject to permitting through the federal Department of Environmental Protection (DEP). Typically, 3,200 feet is the minimum runway length for a non-precision instrument approach (NPI) with visibility minimums of at least 1-statute mile. FAA's Advisory Circular 150/5300-13 states that runways as short as 2,400 feet could support an NPI provides that the lowest height above touchdown[3] (HAT) is designed such that there are no obstacles above 200-feet within the final approach segment to the runway.

[3] The height of the minimum altitude an aircraft can descend prior to landing within the touchdown zone of the runway.

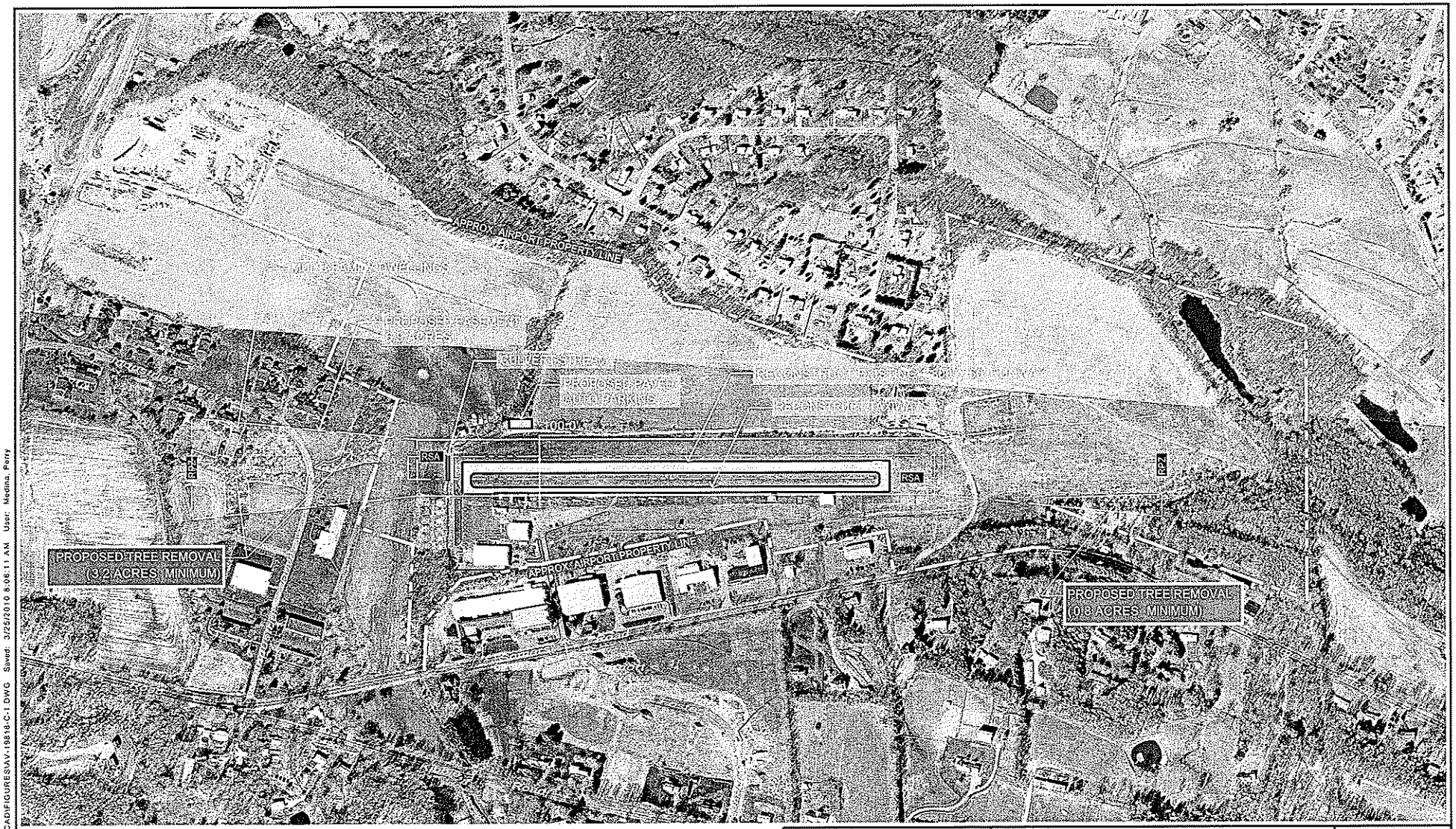
The recommended airfield development may have a decisive impact on the feasibility of the municipal purchase of Ellington Airport. As such, the above options and associated issues were further discussed with Town officials, FAA, ConnDOT, and the airport users.

C.3.2 Landside Options

With the ample land available on the airport property, there are several permutations of hangars that can be explored; Figure C-4 displays one such permutation; however, note that the actual development would be based on demand and funding.

The current tiedowns area would be paved and extended. An additional conventional hangar could be constructed near the existing development for a Fixed Based Operator (FBO) or community aircraft storage. Four additional smaller conventional hangars, for one to two aircraft each, could be constructed on the east side of the Runway 19 end. The land to the west of the runway is graded to suit multiple hangars, including T-hangars and conventional hangars. The intermittent stream to the west of the existing runway will need to be investigated further to determine the impact upon future landside development.

There is additional land in the southwest corner that would have limited aviation use; this land could be used for non-aviation purposes such as commercial or industrial property to increase airport revenue. In order to use the land for non-aviation purposes a land release must be obtained from the FAA or the property could be subdivided prior to public acquisition. To obtain land releases from the FAA, the airport would have to agree to devote all revenues from that land to the operation or capital improvement of the airport.



0 400 800

Scale in feet

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AIRSIDE ALTERNATIVE 2
STATUS QUO

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FIGURE C-1

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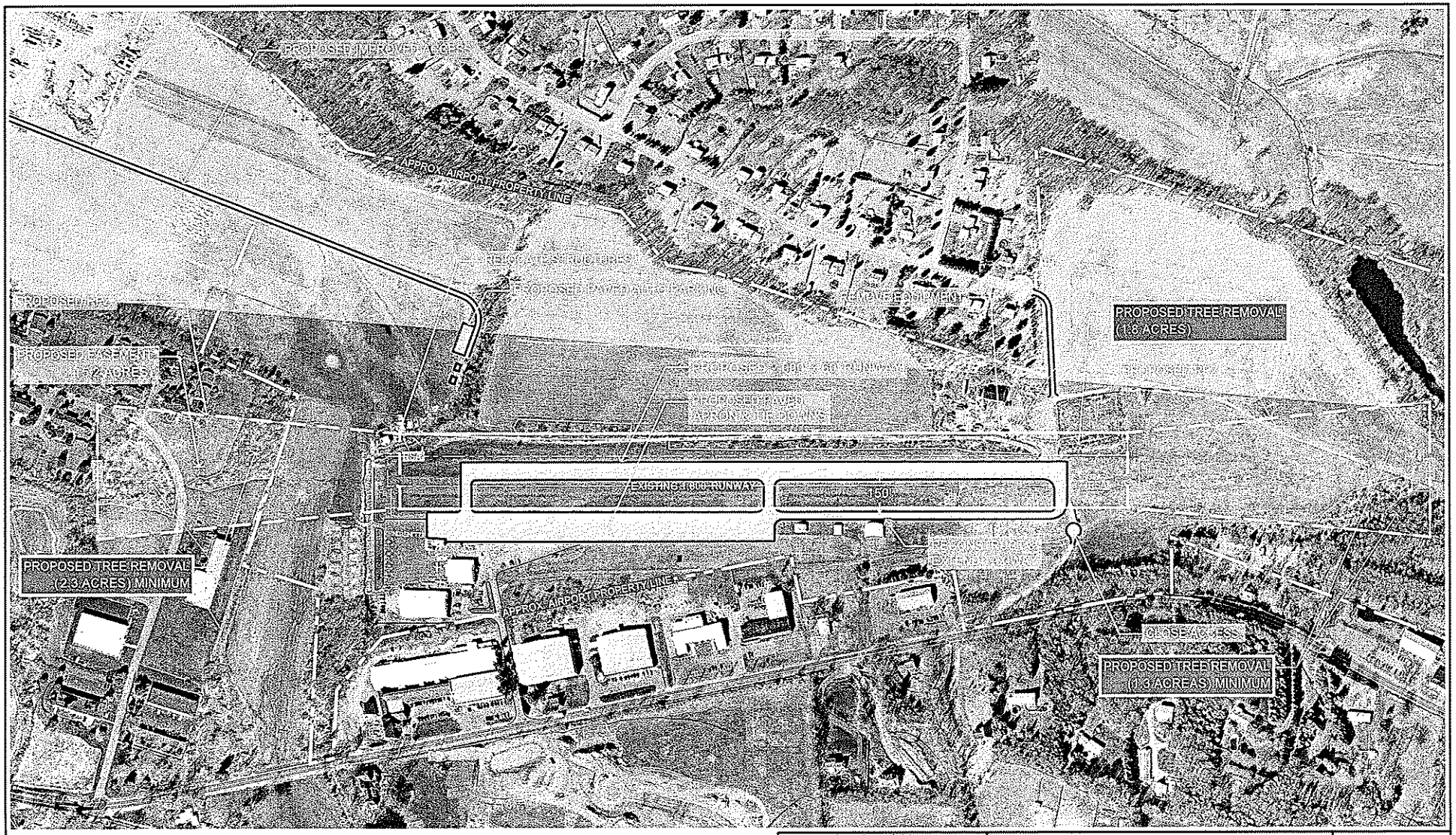

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Scale in feet

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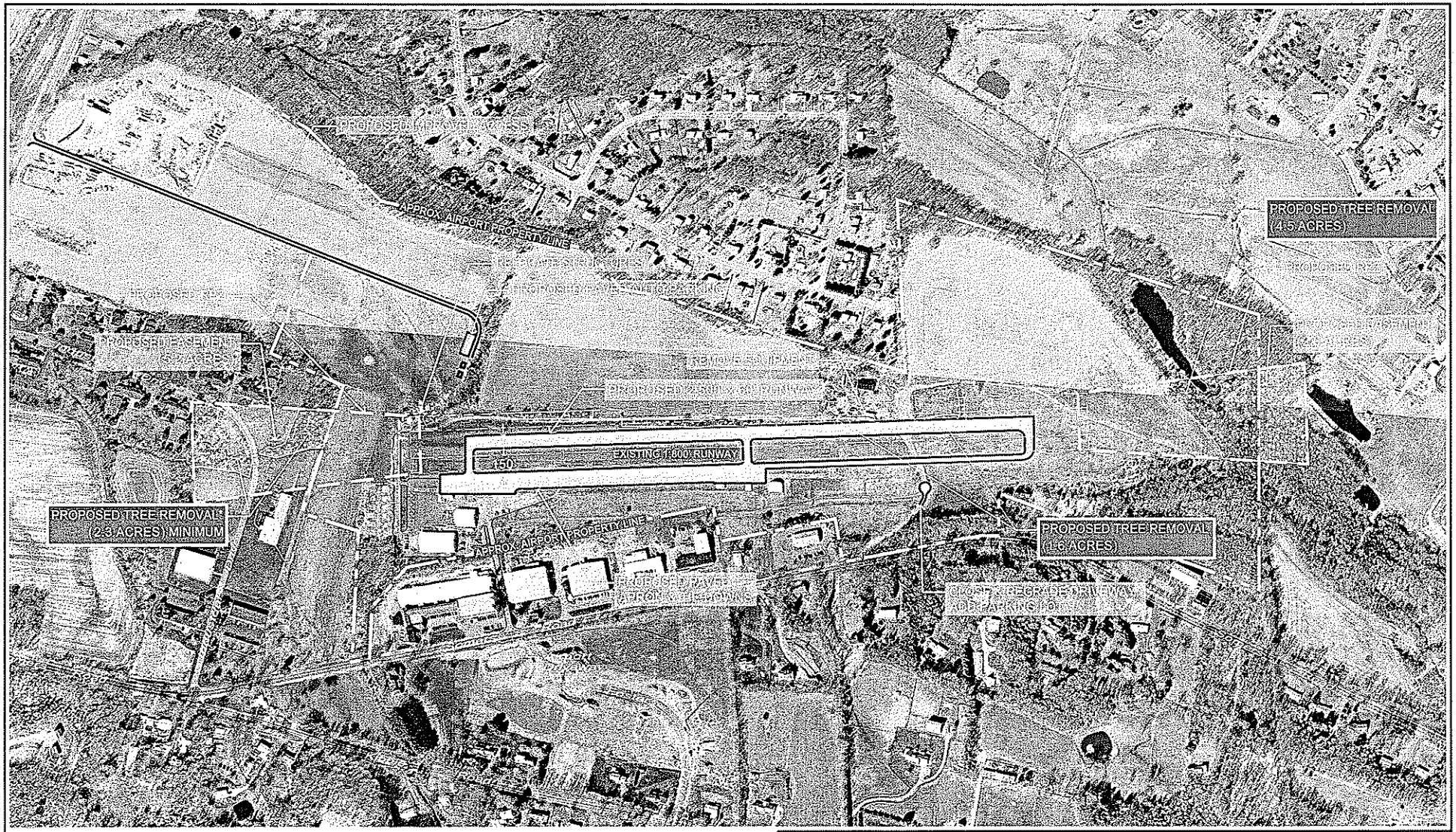
AIRSIDE ALTERNATIVE 3
2,000' RUNWAY

Ellington Airport Acquisition Feasibility Study

PROJECT NO. 19818

DATE: MAY 2010

FIGURE C-2



*Additional tree clearing needed for Non-Precision instrument approach.

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Scale in feet

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AIRSIDE ALTERNATIVE 4
2,500' RUNWAY

Ellington Airport Acquisition Feasibility Study

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DATE: MAY 2010
FIGURE C-3

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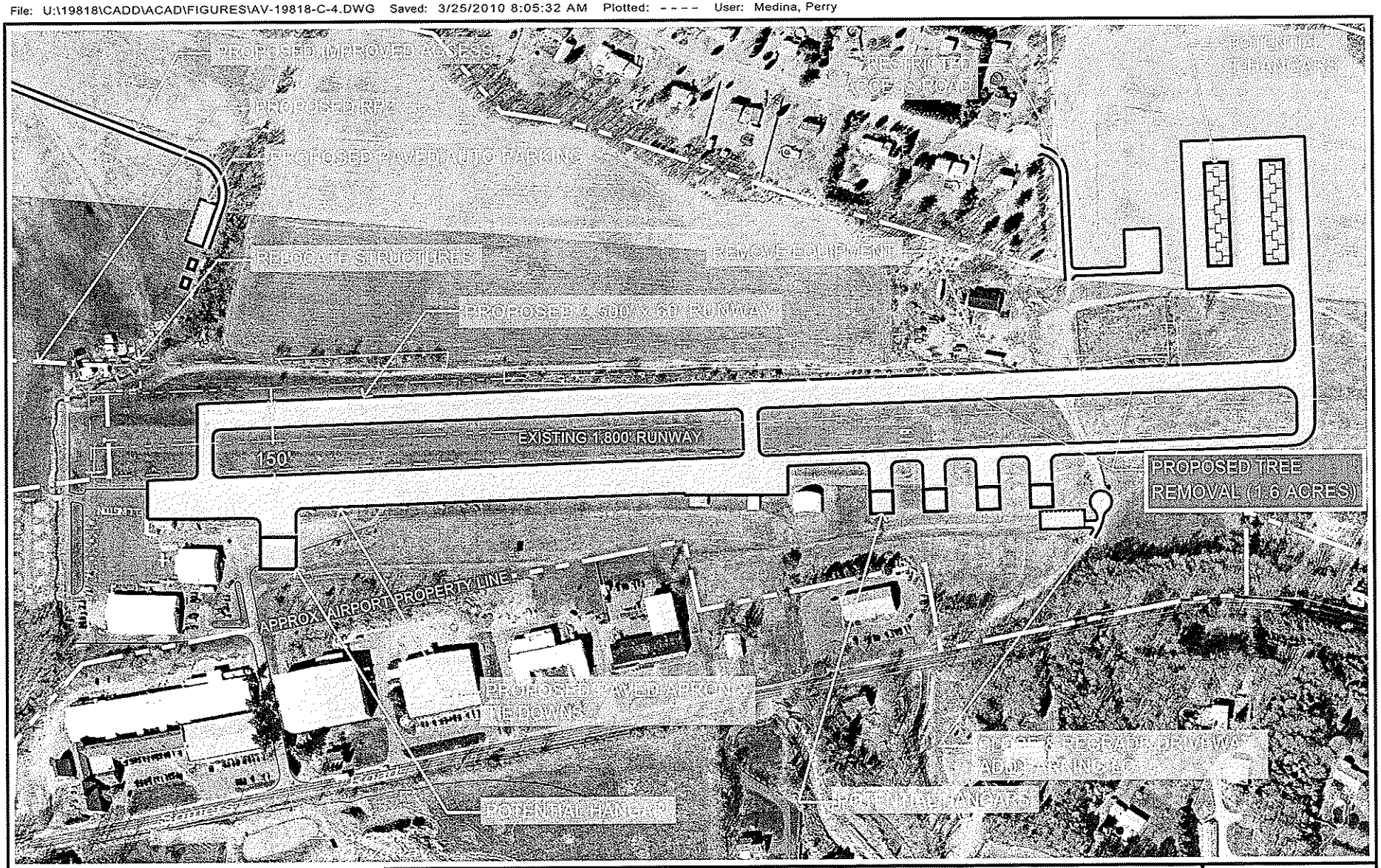

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LANDSIDE ALTERNATIVES

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FIGURE C-4